AMETEK®
TEST & CALIBRATION INSTRUMENTS

User Manual

Handheld Pressure Calibrator

JOFRA HPC550Ex & HPC552Ex

HPC550 Ex/552 Ex
Reference Manual

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1. Introduction

The JOFRA HPC550 Ex/552 Ex is a high accuracy, full function pressure calibrator. The calibrator includes the following features and functions:

- Large graphical LCD display. Intuitive menu system for easy operation of the large number of unique and handy functions and features. The HPC550 Ex/552 Ex is available with one or two built-in sensors, to obtain the best possible solution for your requirements.
- Switch test functionality uses a high speed pressure update rate for superior performance and repeatability.
- Current measurement.
- Temperature measurement capability (Probe optional).
- The HPC550 Ex/552 Ex is available in a great number of pressure ranges, and types. Please see pressure range/accuracy table for further details (Page 39). Vacuum is supported in all units up to 35 bar / 500 psi.

Read this manual carefully before using the instrument and make sure that all safety instructions and warnings are observed.

1.1 Contacting AMETEK/JOFRA

US, Canada, Latin America	AMETEK M&CT 1-800-527-9999
Europe, Africa, Middle East	AMETEK Denmark A/S + 45 4816 8000
Asia	AMETEK Singapore Pte. Ltd. At + 65 (64) 842 388

1.2 Standard Equipment

Inspect the unit carefully upon receipt. Save packing carton in case reshipment is necessary. If there appears to be any damage, equipment missing or if there are any questions about the unit, contact AMETEK.

Check to see if your calibrator is complete. It should include:

- HPC550 Ex/552 Ex Calibrator
- Reference Manual
- Test Leads
- Pressure Fittings
- Calibration Certificate

1.3 Safety information

Ex Hazardous Areas

An Ex-hazardous area as used in this manual refers to an area made hazardous by the potential presence of flammable or explosive vapors. These areas are also referred to as hazardous locations.

The HPC550 Ex/552 Ex calibrator has been designed for use in Ex Hazardous Areas. These are areas where potentially flammable or explosive vapors may occur. These areas are referred to as hazardous (classified) locations in the United States, as Hazardous Locations in Canada, as Potentially Explosive Atmospheres in Europe and as Explosive Gas Atmospheres by most of the rest of the world. The HPC550 Ex/552 Ex calibrator is designed as intrinsically safe. This means that connecting the HPC550 Ex/552 Ex calibrator to equipment that is used within intrinsically safe circuits will not cause an ignition capable arc as long as the entity parameters are suitably matched.

⚠ *Warning*

Check entity parameters before making any connections to this device.

Symbols Used

The following table lists the International Electrical Symbols. Some or all of these symbols may be used on the instrument or in this manual.

Symbol	Description
~	AC (Alternating Current)
≂	AC-DC
	Battery
CE	CE Complies with European Union Directives
⎓	DC
	Double Insulated
	Electric Shock
	Fuse
	PE Ground

Hot Surface (Burn Hazard)

Read the User's Manual (Important Information)

Off

On

The following definitions apply to the terms "Warning" and "Caution".

- "Warning" identifies conditions and actions that may pose hazards to the user.
- "Caution" identifies conditions and actions that may damage the instrument being used.

Use the calibrator only as specified in this manual, otherwise injury and damage to the calibrator may occur.

⚠ *Warning*

To avoid possible electric shock or personal injury:

- Do not apply more than the rated voltage. See specifications for supported ranges.
- Follow all equipment safety procedures.
- Never touch the probe to a voltage source when the test leads are plugged into the current terminals.
- Do not use the calibrator if it is damaged. Before you use the calibrator, inspect the case. Look for cracks or missing plastic. Pay particular attention to the insulation surrounding the connectors.
- Select the proper function and range for your measurement.
- Make sure the battery cover is closed and latched before you operate the calibrator.
- Remove test leads from the calibrator before you open the battery door.
- Inspect the test leads for damaged insulation or exposed metal. Check test leads continuity. Replace damaged test leads before you use the calibrator.
- When using the probes, keep your fingers away from the probe contacts. Keep your fingers behind the finger guards on the probes.
- Connect the common test lead before you connect the live test lead. When you disconnect test leads, disconnect the live test lead first.

- Do not use the calibrator if it operates abnormally. Protection may be impaired. When in doubt, have the calibrator serviced.
- Do not operate the calibrator around explosive gas, vapor, or dust beyond the specified ranges.
- When measuring pressure, make sure the process pressure line is shut off and depressurized before you connect it or disconnect it from the pressure sensor.
- Disconnect test leads before changing to another measure or source function.
- When servicing the calibrator, use only specified replacement parts.
- To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator appears

⚠ *Caution*

To avoid possible damage to calibrator or to equipment under test:

- Use the proper jacks, function, and range for your measurement or sourcing application.

2. Calibrator Interface

Figure 1 shows the location of the input and output connections on the calibrator, while Table 1 describes their use.

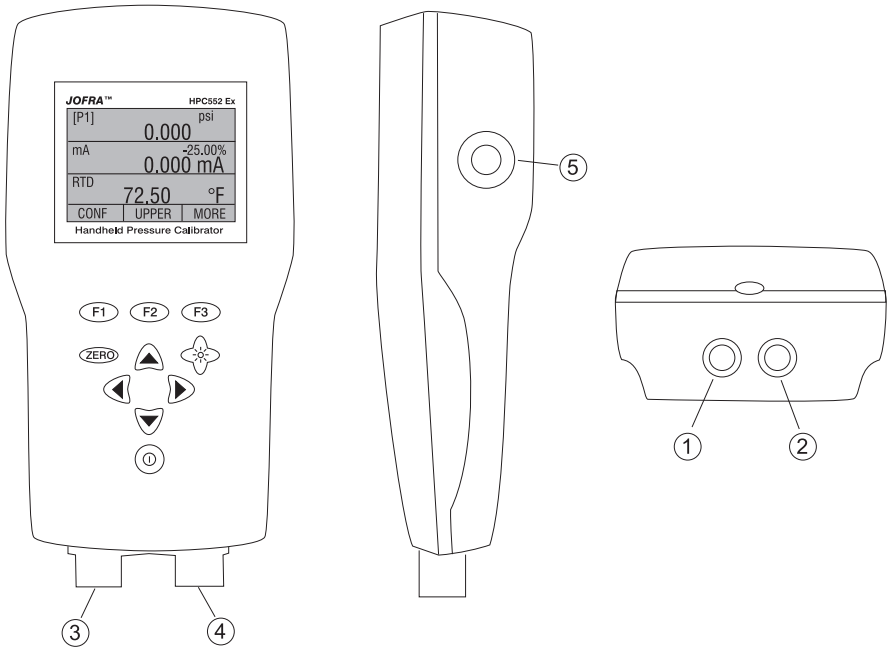


Figure 1. Input/Output Terminals

Table 1: Input and Output Terminals

No.	Name	Description
1, 2	Input Terminals	These terminals are used to measure current and a contact closure for switch test.
3	P1 Pressure Port	This is the connection for the internal sensor [P1]
4	P2 Pressure Port	This is the connection for the internal sensor [P2]
5	RTD Probe Connector	This connector is where the RTD probe is plugged in.

Figure 2 shows the location of the keys on the calibrator. Table 2 lists the functions of each key.

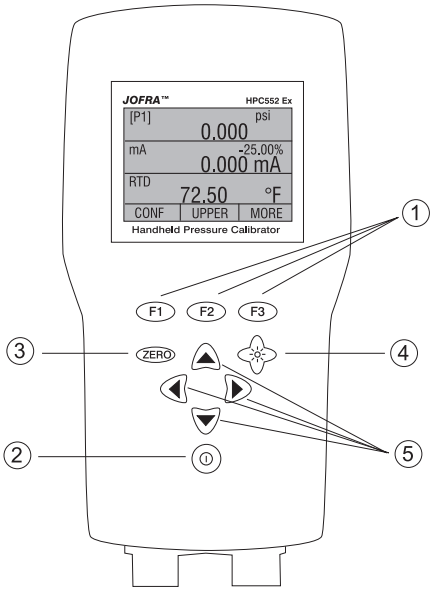


Figure 2. Keypad

Table 2. Key Functions

No.	Name	Function
1	Function Keys	These keys are used in various ways, primarily to configure the calibrator
2	ON/OFF Key	This key is used to turn the calibrator on and off
3	ZERO Key	This key is used to zero pressure measurements
4	Backlight Key	This key is used to turn the backlight on and off
5	Cursor Keys	This key is for setting user inputed values

Note: When the calibrator is turned on by pressing the ON/OFF key, it will go through a short startup self-check routine. During that routine, the display shows the current firmware revision level, auto shutdown status and the ranges of the internal pressure sensors. The calibrator requires a maximum of 5 minutes warm-up to rated accuracy. Large changes in ambient temperature may require a longer warm-up period. See section 2.3 for instructions on zeroing the pressure sensor displays. Pressure ranges should be zeroed each time the calibrator is started. For aboslute sensors zeroing can only be done when a barometric reference is available.

2.1 Calibrator Display

The Calibrator Display consists of two regions: The menu bar (No. 5 on Figure 3, located along the bottom of the screen) is used to access a menu system. The main display (No. 1 on Figure 3) consists of up to three process measurement sub-regions. These sub-regions will henceforth be referred to as the UPPER, MIDDLE and LOWER displays. Figure 3 shows the location of the different display fields while table 3 describes them.

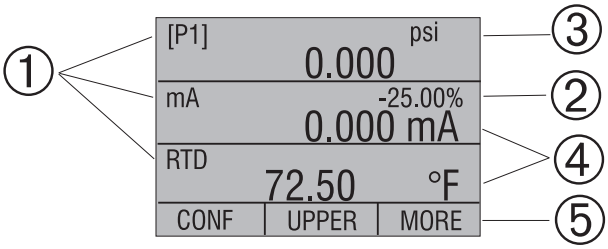


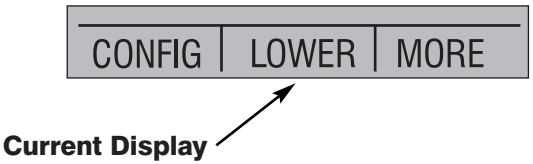
Figure 3. Display

Table 3: Display Functions

No.	Name	Description
1	Primary Parameters	Indicates what is being measured.
2	Span Indicator	Indicates the percent of the 4 to 20 mA span.
3	Pressure Units	Indicates one of 15 pressure units available for display.
4	Units	Indicates the unit of measure for the display.
5	Menu bar	Access to menu systems

2.1.1 Main Menu Functionality

There are three options on the Main Menu, CONFIG, {current display} and MORE. The Main Menu is home for the menu display.



2.1.1.1 Setting the Current Display

The current display is indicated by the center option on the Main Menu, pressing the F2 key will toggle the current display.

2.1.1.2 Setting Current Display Parameters

To set the parameters of the current display use the CONFIG option to get to the Display Configuration Menu.

Here the SELECT option will toggle through the choices for each parameter. The first parameter is MODE. Since current and switch test modes all use the same jacks, two of these functions cannot be used concurrently. The ability to select certain functions is limited based on what is already selected in another active display. The NEXT option is used to change to the second parameter. Only RTD and Pressure modes have a second parameter, RTDs can be read in Celsius or Fahrenheit and Pressures can be read in 15 engineering units.

With a single display the following modes are available:

P[1] = Pressure on left side sensor.

P[2] = Pressure on right side sensor.

P[1] ST = Switch Test with left side sensor.

P[2] ST = Switch Test with right side sensor.

mA = Milliamps measure.

RTD = RTD Temperature Measurement (if a probe is connected).

The following table shows which functions are available concurrently.

An X in a column indicates that the mode in the current display will not be available for selection if the mode in that row is in use in any other active display.

Table 4 Mode Concurrency

CURRENT DISPLAY							
OTHER DISPLAYS		P[1]	P[2]	P[1] ST	P[2] ST	mA	RTD
	P[1]						
	P[2]						
	[Δ/Σ]						
	P[1]ST			X	X	X	
	P[2]ST			X	X	X	
	mA			X	X		
	RTD						

Note: P2 is only available on the double sensor version of HPC550-Ex/552-Ex.

2.1.1.3 Accessing Other Menus

Use the MORE option on the Main Menu to access the other menu functions.

2.2 Using the Backlight

The backlight is controlled by the dedicated backlight key. It toggles on and off when the key is pressed; There is a user defined timer configuration settings for the backlight in the functions menu system (2.4.12)

2.3 Using the Zero Function

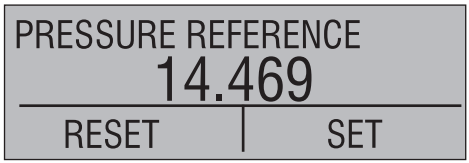
When the ZERO KEY is pressed, the calibrator will zero the current display if a pressure mode is selected, and the pressure is within the zero limit. The zero limits are within 5% of the full scale range of the selected sensor. If the display indicates "OL," the zero function will not operate."

2.3.01 Internal Sensor

When a sensor is selected on the current display and the ZERO KEY is pressed the calibrator subtracts the current reading from the output. The zero limits are within 5% of the full scale range of the selected sensor. If the display indicates "OL," the zero function will not operate.

2.3.02 Absolute Internal Sensor

When an absolute pressure sensor is selected on the current display and the ZERO KEY is pressed the calibrator displays the current barometric pressure on the lower display. At this point the user has two options. With the port open (vented) to atmosphere, and with access to a high accuracy barometric reference, the user can utilize the cursor keys to adjust the current value to the barometric reference pressure and store it in the calibrator using the SET key. The second option is to use the RESET key to return the barometric offset to the factory setting. After pressing either the SET or RESET key the user will be prompted to either confirm or cancel their selection



2.4 Menu Controlled Functions

There are 14 'sub-main' menus that can be accessed through the MORE option of the Main Menu. A 'sub-main' menu contains three options. The first option is unique to the function. The second and third options of a 'sub-main' menu are always the same. The NEXT option leads to the next 'sub-main' menu and the DONE option returns to main window . For the last 'sub-main' menu the NEXT option wraps around to home. See Appendix X (pages 41 & 42) Menu Tree, for a detailed mapping of the menu structure.

A note on naming convention:

If a 'sub-main' menu has subordinate menus, it will henceforth be referred to as {function} Main Menu. E.g. the display contrast sub-main menu will be called the Contrast Main Menu. If not it will be called the {function} menu.

2.4.01 %ERROR, on line calculation of sensors error % ….. Page 11
2.4.02 LEAK TEST, automatic leak test timer function…….Page 13
2.4.03 MINMAX, min / max hold…… Page 15
2.4.04 Δ/Σ, delta / summary calculation …… Page 16
2.4.05 CONTRAST, display contrast adjustment…….... Page 17
2.4.06 LOCK CFG, instrument setup lock…… Page 18
2.4.07 SETUPS, store or recall of setups…… Page 18
2.4.08 AUTO OFF, setup of automatic off timer……... Page 19
2.4.09 DISPLAY, setup numbers of display windows……..... Page 19
2.4.10 PROBE TYPE, Setup of temperature sensor type…… Page 20
2.4.11 RESULOTION, select display resolution……..……..Page 21
2.4.12 LIGHT TIMER, setup of backlight timer…… Page 21
2.4.13 DAMP, normal or slow display update rate…….. Page 22

2.4.01 %ERROR calculation

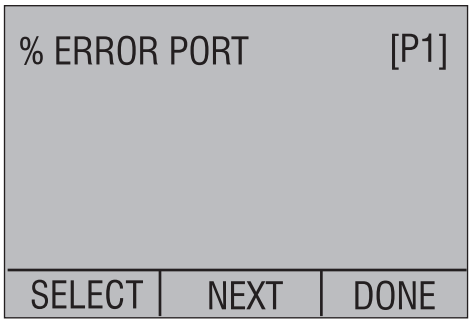
⚠ *Warning*

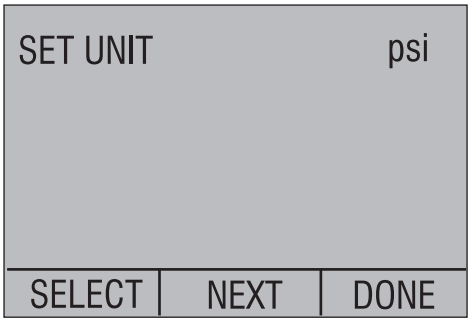
Check entity parameters before making any connections to this device.

The calibrator features a function which can calculate pressure vs. milliamp error as a percentage of the 4 to 20 mA loop span. The percent error mode uses all 3 screens and has a unique menu structure. It simultaneously displays pressure, mA and error percent.

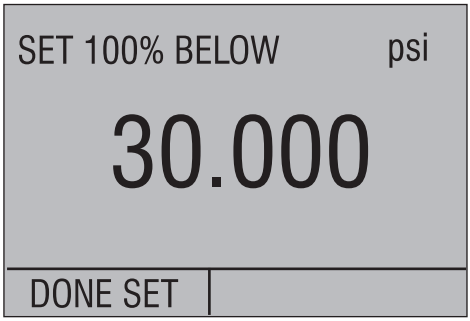
To use the %ERROR function proceed as follows:

1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Now press the F1 key to activate the %ERROR option.
2. Press the F1 key to select the CONFIG option.
3. The first option is setting the Port, use the select option to scroll through the port choices, when finished select the NEXT option.

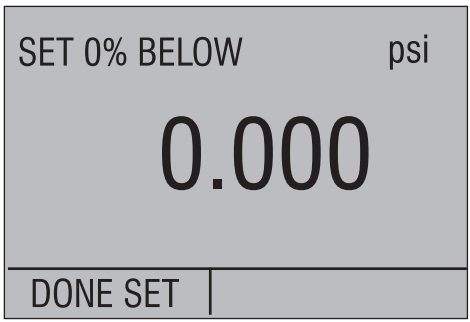




5. Use SELECT to toggle through the UNIT options, and select NEXT to move on.



6. Use the cursor keys to set the 100% point of the desired pressure range, select DONE SET when finished.



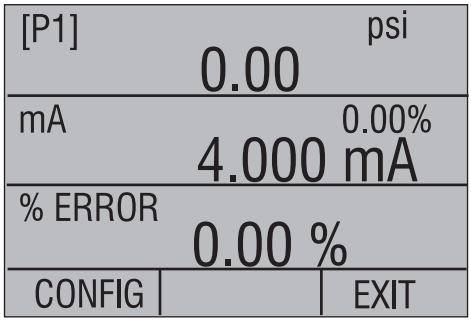
7. Again, use the cursor keys to set 0% point and select DONE SET when finished and the %ERROR mode will be ready to use.

Note: The 0% and 100% point will be saved in non-volatile memory until they are changed again by the user for the internal sensors.

EXIT leaves the %ERROR mode

Warning

Check entity parameters before making any connections to this device.



2.4.02 LEAK TEST

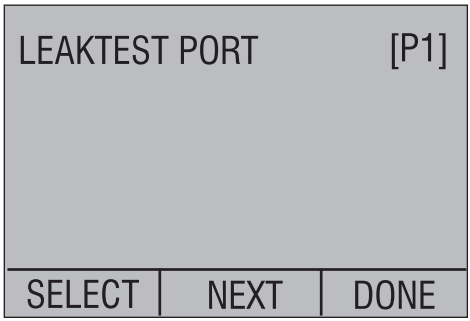
Warning

Check entity parameters before making any connections to this device.

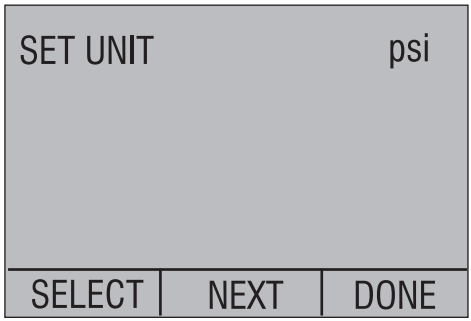
The calibrator features a leak test function which calculate leak rate. The timer can be set from 5 to 120 seconds, regardless of the set time the leak rate is calculated in leak per minute. The function gives a good and repeatable expression for the leak of a pressure system. This feature might be used before calibration to document / indicate leak rate.

To use the leak rate function proceed as follows:

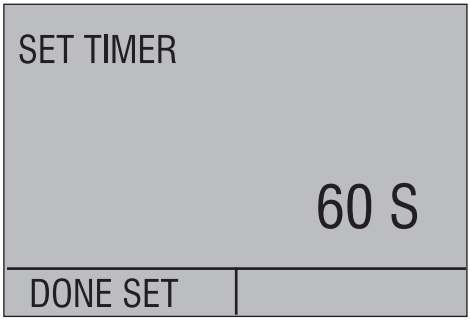
1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Press the NEXT button until LEAK TEST appears in the left text field. Now press the F1 key to activate the leak test option.
2. Press the F2 key to select the CONFIG option.
3. The first option is setting the Port, use the select option to scroll through the port choices, when finished select the NEXT option.



4. Use SELECT to toggle through the UNIT options, and select NEXT to move on.

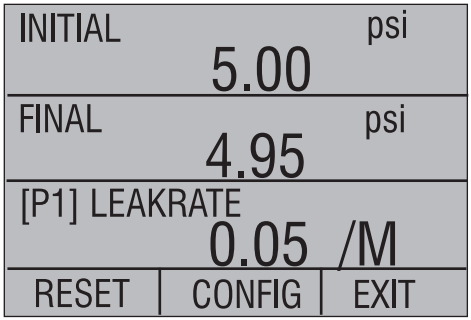


5. Use cursor keys to set test time, and press DONE SET to confirm.



Note: The units and time will be saved in non-volatile memory until they are changed again by the user. They may be used at the next leak test without having to do the configuration each time.

6. To start leak test press F1 button, the time is counted down, and the Initial, Final and calculated leak rate in pressure pr. Minute is shown.



EXIT leaves the leak rate function.

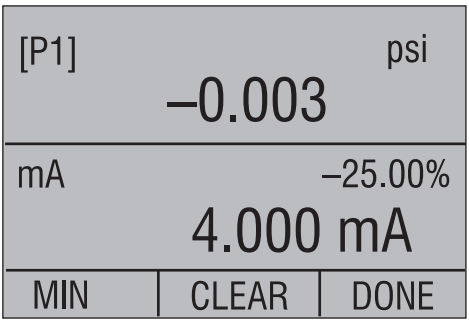
2.4.03 MIN MAX hold

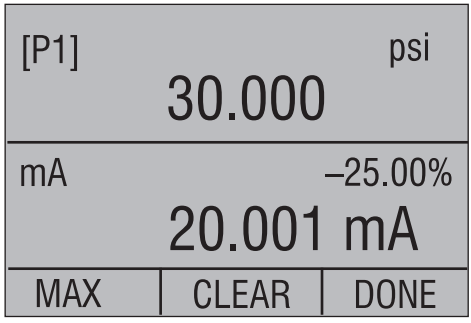
The JOFRA HPC550 Ex/552 Ex Pressure Calibrators have a min/max feature for capturing the minimum and maximum values of any displayed parameter.

To use the MIN / Max storage function proceed as follows:

1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Press the NEXT button until MINMAX appears in the left text field, now press the F1 key to activate the Min / Max storage function.

2. After the Min / Max have been activated, pressing the F1 key will toggle the display through the min/max values that are stored in the min/max registers. These readings are live so that the new min/max values will be recorded while in this mode. To reset the min/max registers simply press the clear key. These registers are also cleared at power-up, when pressure is zeroed or when the configuration is changed.





The Min / Max mode is cancelled by pressing F3

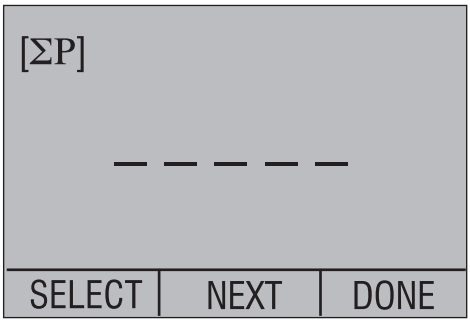
2.4.4 Δ/Σ mode (Delta / Sum mode)

The calibrator features the ability to subtract or add two specified pressure readings. An application of the Δ function is differential measurements. An application for the Σ function is pseudo absolute measurement. Where the barometric pressure can be taken by an absolute sensor and added to the value of another gauge sensor giving you an absolute pressure reading.

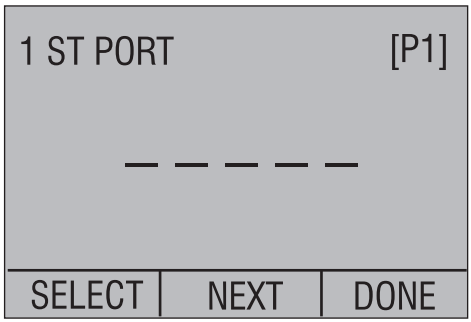
To use the Δ/Σ function proceed as follows:

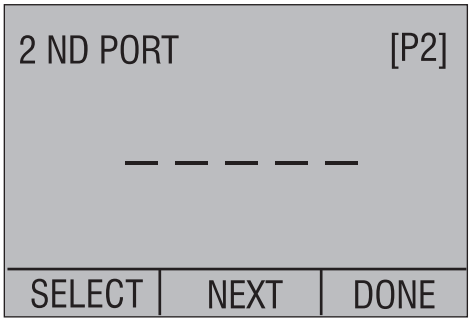
1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Press the NEXT button until SETΔ/Σ appears in the left text field. Now press the F1 key to activate the function. Please note Δ function is [port1] - [port2] and Σ function is [port1] + [port2].
2. The first option is setting either Δ or Σ, use select option to chose, when finished select the NEXT option.

The 2nd option is setting the 1st Port, use select option to scroll through the port choices, when finished select the NEXT option.

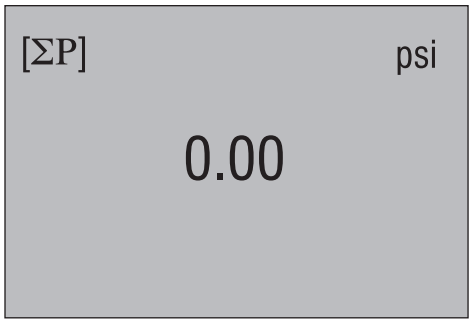


3. The 3rd option is selecting the 2nd port, use select option to scroll through the port choices, when finished select the NEXT option.





4. The Δ/Σ function is now configured, and can be chosen in the main menu, for the desired display via the normal CONFIG / SELECT procedure.



Note: The setup will be saved in non-volatile memory until it is changed again by the user. It may be used at the next leak test without having to do the configuration each time.

2.4.05 Setting the Display Contrast

1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Press the NEXT button until CONTRAST appears in the left text field, now press the F1 key to activate the contrast adjustment function.
2. Use the cursor keys to adjust the display contrast to the desired level and then use the CONTRAST DONE option to return home.

2.4.06 Locking and Unlocking Configurations

When the LOCK CFG option is chosen the menu display returns home and the CONFIG option on the Main Menu indicates that it is locked. Also all menus are locked out with the exception of the %ERROR, LEAK TEST, MINMAX, SET Δ/Σ and CONTRAST menus and the Configuration Lock Menu. When the UNLOCK CFG option is chosen the configuration is unlocked and the menu display continues to the next sub-main menu.

To use the Locking function proceed as follows:

1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Press the NEXT button until LOCK CFG appears in the left text field. Now press the F1 key to activate the function. To reactivate the function use UNLOCK CFG in the same way.

2.4.07 Saving and Recalling Setups

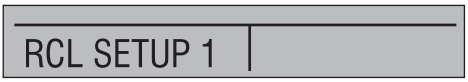
The calibrator will automatically save the current set-up for recall at power-up. Additionally 5 set-ups can be accessed through the SETUPS menu.

To use the Locking function proceed as follows:

1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Press the NEXT button until SETUPS appears in the left text field. Now press the F1 key to enter the function.

2. Choose SAVE to save a set-up , RECALL to recall the set-up, or DONE to do nothing and return home.

If SAVE or RECALL is selected use the cursor keys to select the set-up location. Then use the save option to store the current set-up into the selected location or the recall option to recall the set-up stored in the selected location. The display menu will automatically go home.



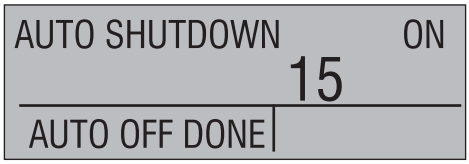
2.4.08 Setting AutoShut-off Parameters

The calibrator can be set to automatically shut-off after a selected number of minutes; this function can also be disabled.

To change parameters proceed as follows:

1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Press the NEXT button until AUTO OFF appears in the left text field. Now press the F1 key to enter the setup.
2. To set the auto shut off parameters select the AUTO OFF option on the Auto Shut Off Main Menu.

3. Use the cursor keys to select the number of minutes before the calibrator turns off or disable auto shut-off by scrolling all the way down to 0.



4. Use the AUTO OFF DONE option to set the parameters and return home. The auto shut off time is reset whenever a key is pressed.

2.4.09 Activating and Deactivating a Display

This is where the number of active measuring windows / channels are selected, 1, 2 or 3 windows can be selected, to give the optimal mix between text size, overview and amount of information.

To select the number of windows, proceed as follows:

1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Press the NEXT button until DISPLAY appears in the left text field. Now press the F1 key to enter the function.

2. The NEXT option can be used to select which display to act upon. The ON/OFF option turns the selected display on or off. The selected display and current on/off state are displayed in the lower display.

3. Use the DONE option to save the changes and return home. When a display is deactivated its configuration is retained. When the display is activated its configuration is checked against the configurations of the other currently active displays, if the configurations are in conflict the recalled display's configuration is modified to avoid the conflict. If all three displays are deactivated the LOWER display will come on automatically

2.4.10 Setting the RTD probe type

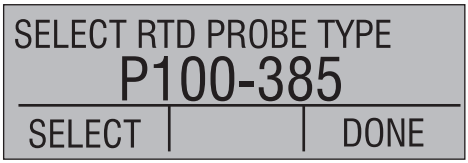
The JOFRA HPC550 Ex/552 Ex have a built in high accuracy RTD thermometer, it works with an RTD sensor (optional).

To select type of temperature sensor proceed as follows:

1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Press the NEXT button until PROBE TYPE appears in the left text field. Now press the F1 key to enter the function.

2. There are four probe types to select from P100-385, P100-392, P100-JIS and CUSTOM. Use the SELECT option to select the desired probe type and the DONE option to store the change and return home.

Note: The default probe type is PT100-385.



3. Pressing DONE leaves the temperature selection function

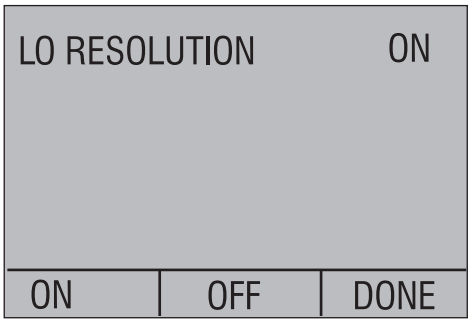
2.4.11 Low resolution function.

Due to the high accuracy of the JOFRA HPC550 Ex/552 Ex the measured values are displayed with many digits, this might be an disadvantage in some cases, therefore the HPC has a low resolution function. The function takes away the last digit.

To turn the function on or off, proceed as follows:

1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Press the NEXT button until RESOLUTION appears in the left text field. Now press the F1 key to enter the function.

2. The select ON or OFF to turn the low resolution function on or off.



3. Pressing DONE returns to main menu.

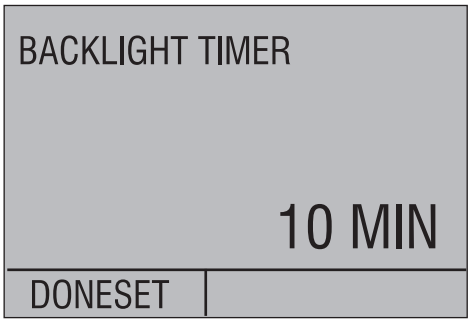
2.4.12 Setting display Light-off Parameters

The calibrator will automatically shut-off the display back light after a selected number of minutes.

To change parameters proceed as follows:

1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Press the NEXT button until LIGHT TIMER appears in the left text field. Now press the F1 key to enter the setup.

2. Use the cursor up/down keys to select the number of minutes before the light turns off.



3. When the desired time has been reached, press DONE SET to return to main menu.

2.4.13 Switching damping on or off.

To give a more stable reading on fluctuating readings, the HPC550 Ex/552 Ex has a damping function. This function applies to internal sensors only. When damping is ON, the calibrator displays a running average reading of ten measurements. The calibrator takes approximately 3 readings per second.

To switch in or out damping proceed as follows:

1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Press the NEXT button until DAMP appears in the left text field. Now press the F1 key to enter the setup.

2. Switches damping on or off.
3. DONE returns to main menu.

3. Measuring Pressure

Warning

Check entity parameters before making any connections to this device.

To measure pressure, connect the calibrator using an appropriate fitting. Choose a pressure setting for the display being used. The calibrator is equipped with one or two internal sensors. Be sure to choose the sensor based on working pressures and accuracy.

Note:

Pressure sensors may be damaged and/or personnel injury may occur due to improper application of pressure. Please refer to the table of ranges and resolutions at the back of this manual for information on overpressure and burst pressure ratings. Vacuum should not be applied to any gauge pressure sensor. The calibrator display will indicate "OL" when an inappropriate pressure is applied. If "OL" is observed on any pressure display, the pressure should be reduced or vented immediately to prevent damage or possible personnel injury. "OL" is displayed when the pressure exceeds 120% of the nominal range of the sensor or when a vacuum in excess of 2 PSI is applied on gauge range sensors.

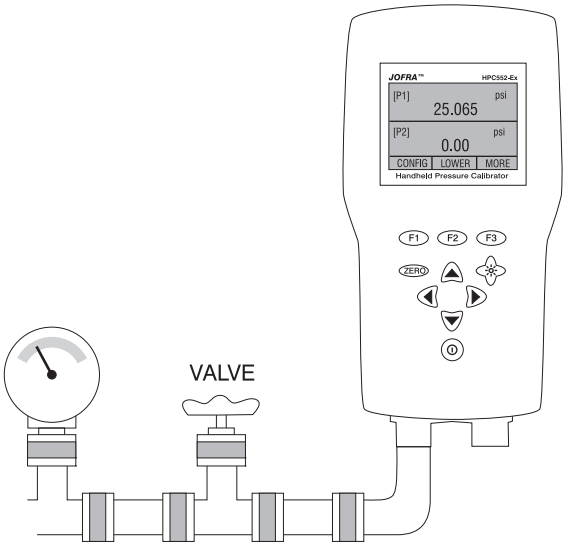


Figure 4

Use the (ZERO) key to zero the pressure sensor when vented to atmospheric pressure.

Important NOTE: To protect sensor integrity and prevent damage to the sensor, the calibrator will display OL [overload] when the applied pressure exceeds 120% of the full scale calibrated range of the sensor.

Important NOTE: To ensure accuracy of the calibrator it is critical to zero the calibrator before a device is calibrated.

3.1 Media Compatibility

The calibrator utilizes a media isolated sensor to prevent sensor contamination. Whenever possible clean, dry air is the media of choice. If that is not always possible, make sure that the media is compatible with Nickel Plated Brass and 316 Stainless Steel.

4. Measuring Current

Warning

Check entity parameters before making any connections to this device.

To measure current use the input terminals on the top of the calibrator. Select the mA function on one of the displays. Current is measured in mA and percentage of range. The range on the calibrator is set to 0% at 4 mA and 100% at 20 mA.

Note: The display will indicate "OL" when the measured current exceeds the nominal range of current measurement (24 mA).

For example:

If the current measured is displayed as 75% then the mA value is 16 mA.

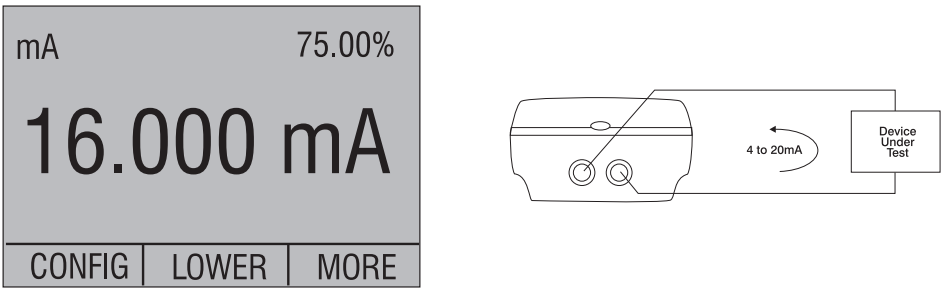


Figure 5

5. Measuring Temperature with an RTD

To measure temperature using an RTD probe you must select the RTD function on one of the displays. Make sure the proper probe type is selected. There are 4 probe types supported, P100-385, P100-392, P100-JIS and CUSTOM.

Note: The factory default type is PT100-385 so if the HPC550 Ex/552 Ex is being used with the AMETEK/JOFRA sensor you do not have to set the probe type. Simply plug the probe into the HPC550 Ex/552 Ex and configure the display to read temperature.

Note: The display will indicate "OL" when the measured temperature is outside the nominal measurement range of the RTD function (below -40°C or above 155°C).

If a custom probe is being used, the entering of R0 and coefficients is handled through the serial interface (see section 11 and communication manual).

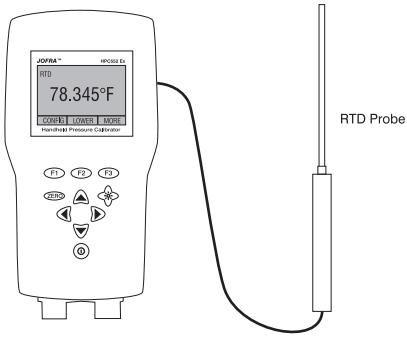


Figure 6

6. Performing a Pressure Switch Test

⚠ *Warning*

Check entity parameters before making any connections to this device.

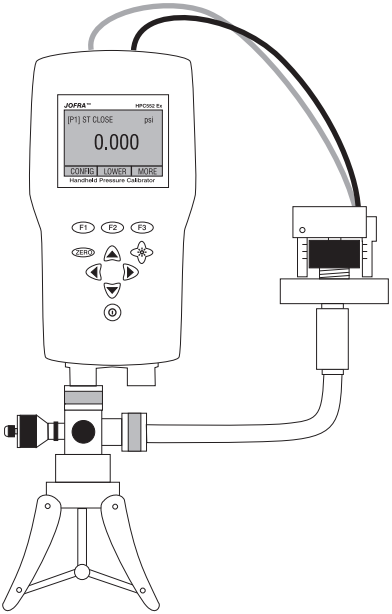


Figure 7

To perform a switch test, follow these steps:

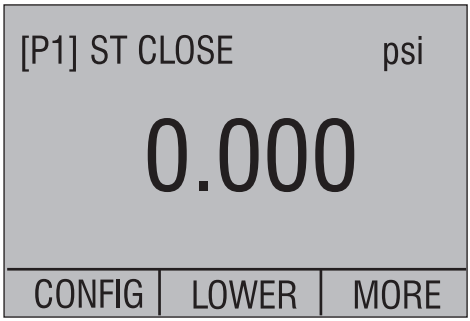
1. Change the setup to Setup 4 (default switch test).

   Setup 4: The upper display is set to [P1] ST, all other displays are off.

   Important NOTE: The pressure Switch Test can be performed with the following functions[P1] ST, [P2] ST.

2. Connect the calibrator to the switch using the pressure switch terminals. The polarity of the terminals does not matter. Then connect the pump to the calibrator and the pressure switch.
3. Make sure the vent on the pump is open. Zero the calibrator if necessary. Close the vent after zeroing the calibrator.

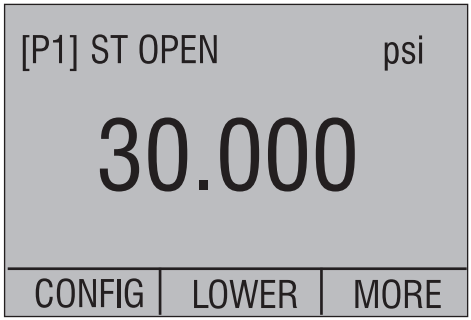
4. The top of the display will read "CLOSE".



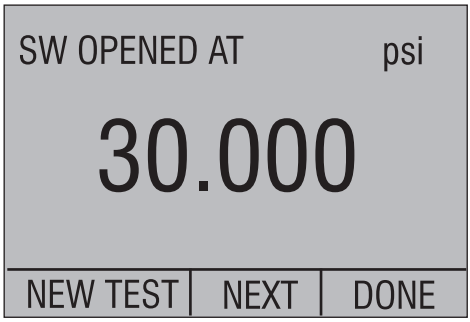
5. Apply pressure with the pump slowly until the switch opens.

Important NOTE: In the switch test mode the display update rate is increased to help capture changing pressure inputs. Even with this enhanced sample rate pressurizing the device under test should be done slowly to ensure accurate readings.

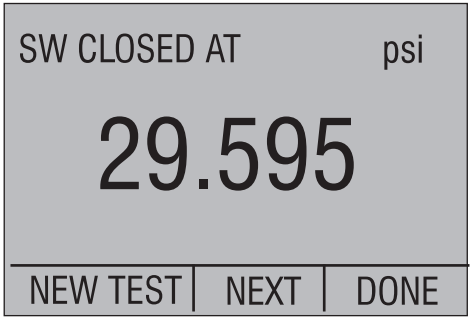
6. Once the switch is open, "OPEN" will be displayed, bleed the pump slowly until the pressure switch closes.

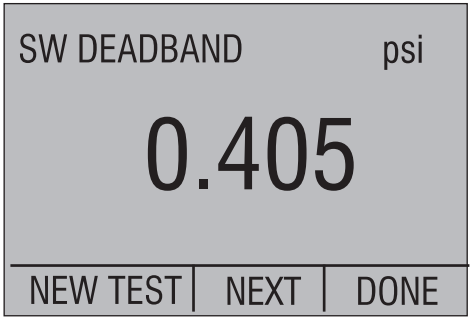


7. At the top of the display it will now read, "SW OPENED AT" and give you the pressure that the switch opened at.



8. Press the "NEXT" option to view when the switch closed, and the dead band.





9. Press the "NEW TEST" option to clear the data and perform another test.
10. Press the "DONE" option to end the test and return to the standard pressure setting.

Important NOTE: The following example uses a normally closed switch. The basic procedure is still the same for a normally open switch, the display will just read "OPEN" instead of "CLOSE".

Example:

[P1] ST will return to [P1].

7. Calibrating Transmitters

Warning

Check entity parameters before making any connections to this device.

7.1 Using the mA Input Function

The mA input function allows the user to read back the 4-20 mA output from the device being calibrated.

7.2 Calibrating a Pressure-to-Current Transmitter

To calibrate a pressure-to-current transmitter (P/I), perform the following steps:

1. Connect the calibrator and the pump to the transmitter.
2. Apply pressure with the pump.
3. Measure the current output of the transmitter.
4. Ensure the reading is correct. If not, adjust the transmitter as necessary.

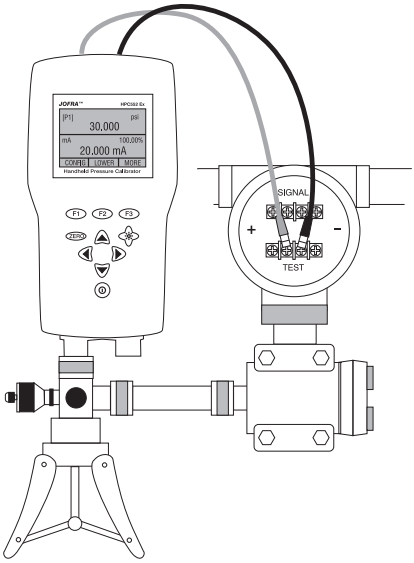


Figure 8.

7.3 Percent Error Function

Warning

Check entity parameters before making any connections to this device.

The calibrator features a unique function which can calculate pressure vs. milliamp error as a percentage of the 4 to 20 mA loop span. The percent error mode uses all 3 screens and has a unique menu structure. It simultaneously displays pressure, mA and percent error.

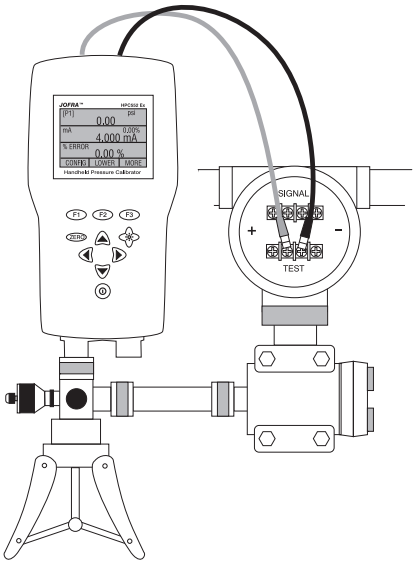


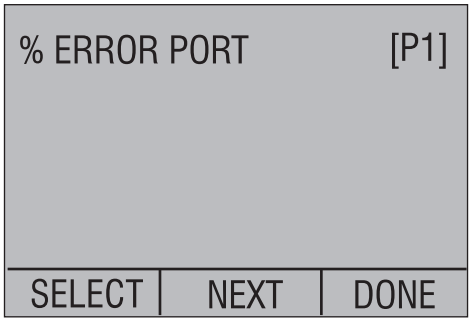
Figure 9.

Example:

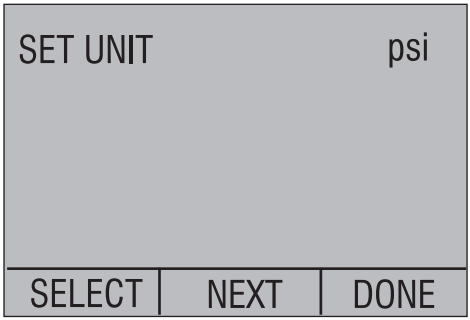
Suppose a pressure transmitter under test is 30 psi (2 Bar) Full Scale and outputs a corresponding 4 to 20 mA signal. The user can program in a 0 to 30 psi pressure span into the calibrator and the calibrator will calculate and display the deviation or % Error from the expected 4 to 20 mA output. This eliminates the need for manual calculations and also helps if it becomes difficult to set an exact pressure with an external pump.

To use the %ERROR function proceed as follows:

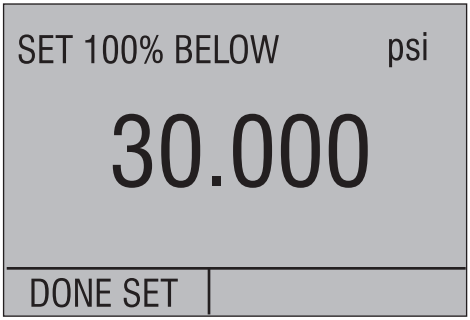
1. With the calibrator turned on and operating press the F3 key to activate the MORE menu option. Now press the F1 key to activate the %ERROR option.
2. Press the F1 key to select the CONFIG option.
3. The first option is setting the Port, use the select option to scroll through the port choices, when finished select the NEXT option.



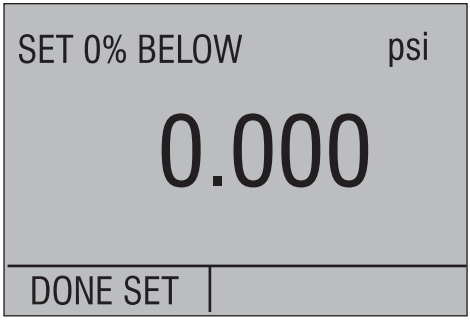
4. Use SELECT to toggle through the UNIT options, and select NEXT to move on.



5. Use the cursor keys to set the 100% point of the desired pressure range, select DONE SET when finished.



6. Again, use the cursor keys to set 0% point and select DONE SET when finished and the %ERROR mode will be ready to use.

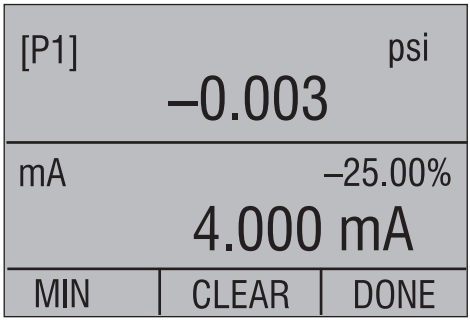


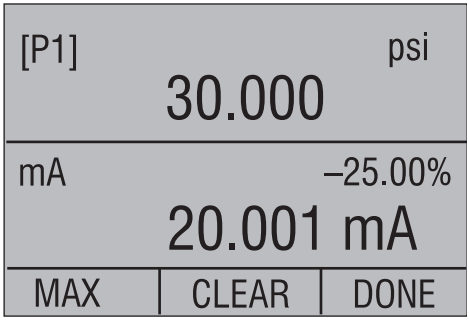
Note: The 0% and 100% point will be saved in non-volatile memory until they are changed again by the user.

8. Minimum and Maximum Storage Capability

The JOFRA HPC550 Ex/552 Ex Pressure Calibrators have a min/max feature for capturing the minimum and maximum values of any displayed parameter.

The min/max function can be accessed by stepping through the menu options until "min/max" is shown on the display above the F1 key. At this time, pressing the F1 key will toggle the display through the min/max values that are stored in the min/max registers. These readings are live so that the new min/max values will be recorded while in this mode.

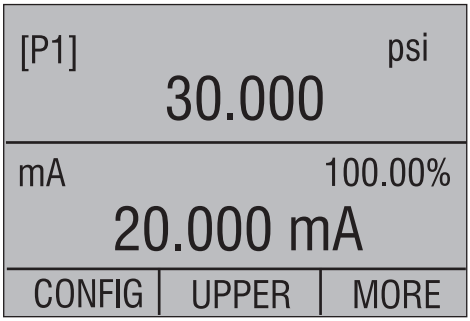




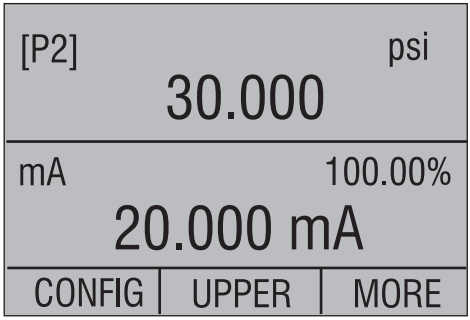
To reset the min/max registers simply press the clear key. These registers are also cleared at power-up or when the configuration is changed.

9. Factory Setups

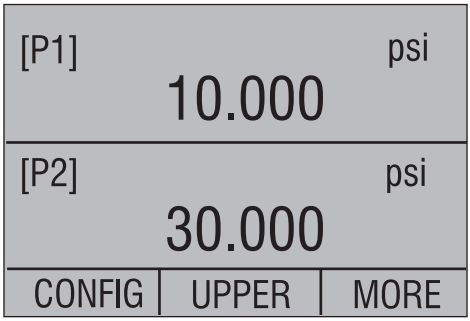
The Calibrator is loaded with five factory setups. These setups are shown below.



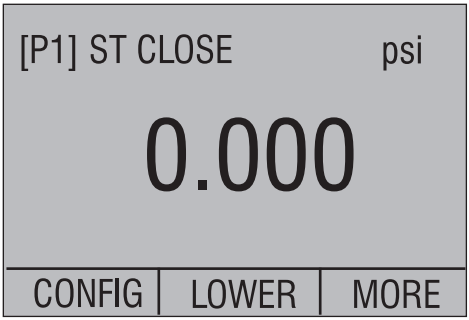
Setup 1: The upper display is set to [P1] mode and the middle is set to mA, lower is off.



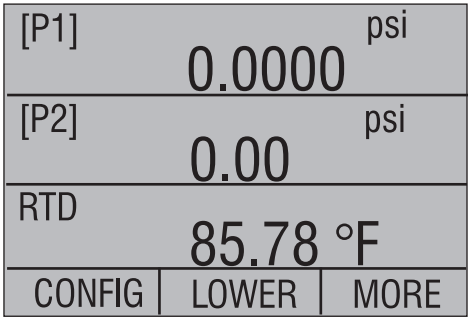
Setup 2: The upper display is set to [P2] mode and the middle is set to mA, lower is off.



Setup 3: The upper display is set to [P1] mode and the middle is set to [P2], lower is off.



Setup 4: The lower display is set to [P1] switch test, the other displays are off.



Setup 5: The upper display is set to [P1], the middle display is set to [P2] and the lower display is set to RTD.

10. Custody Transfer / Flow Calibration

Warning

Check entity parameters before making any connections to this device.

The HPC550 Ex/552 Ex is ideal for flow computer calibration. Every manufacturer of flow computers has a different calibration procedure, but most call for calibration of three parameters: static pressure, differential pressure and temperature. To facilitate these measurements recall setup #5 on the HPC550 Ex/552 Ex.

Note: The pressures in the UPPER, and MIDDLE displays can be changed to [P1], [P2].

1. Connect the calibrator to your static and differential pressures. ([P1], [P2]) Then connect the RTD sensor to the calibrator.
2. Using the reading of your RTD, static, and differential pressures, make sure the flow computer has the correct reading. If not, adjust the flow computer as necessary.

11. Specifications *(18 °C to 28 °C unless otherwise noted.)*

General

Instrument Setup Recall	5; last used on power-up
Environmental Operating Temperature Storage Temperature Ingress Protection	 -10 °C to +45 °C -20 °C to +60 °C IP54
Power Requirements Battery Battery Life	6.0 VDC Four (4) standard AA cells > 35 hours, typical usage
Physical Dimensions Weight	 8.3" H x 3.9" W x 2.0" D (200.9 x 99.1 x 50.1 mm) 1 lb. 7 oz. (0.651 kg) with batteries installed
Product Compliance Markings	Ex ia IIB T3 Gb (Ta=–10... +45°C) CE 0344 KEMA 10 ATEX 0168X Ex ia IIB T3 Gb (Ta=–10... +45°C) II 2 G IECEx CSA 10.0013X Manufactured by Martel Electronics, Inc., 3 Corporate Park Dr. Derry, NH, USA
Entity Parameters	MEASUREMENT JACKS: Ui = 30 V; Ii = 80 mA; Pi = 750 mW; Ci = 0 μF; Li = 0 mH; Uo = 7,14 V; Io = 1,12 mA; Po = 2 mW; Co = 240 μF; Lo = 1 H LEMO CONNECTOR: FOR USE WITH HPC-T RTD PROBE ONLY
EMI/RFI Conformance	EN61326
Connectors/Ports	Pressure (HPC550 Ex) - one, 1/8" BSP female Pressure (HPC552 Ex) - two, 1/8" BSP female RTD probe

Included Accessories

Item	HPC550 Ex and HPC552 Ex
1/8" male BSP to ¼" female BSP	Standard 2 pcs. if dual sensor or differential
1/8" male BSP to ¼" male NPT	Standard 2 pcs. if dual sensor or differential
1/8" sealed gasket2 type washer	Standard 2 pcs. if dual sensor or differential
Read + Black test lead and clips	Standard
Hand strap w/clip	Standard
NIST traceable calibration certificate	Standard
User manual	Standard
RS232 cable	Option
Soft case	Option

Ranges

Gauge:	70 bar (1000 psi) 200 bar (3000 psi) 350 bar (5000 psi) 700 bar (10,000 psi)
Absolute:	1.1 bar (16 psi) 2 bar (30 psi) 7 bar (100 psi) 20 bar (300 psi)
Differential:	+/- 25 mbar (+/- 0.4 psi) +/- 70 mbar (+/- 1psi) +/- 350 mbar (+/- 5psi)
Compound:	+/- 1 bar (-14 to 15 psi) -1 to 2 bar (-14 to 30 psi) -0.82 to 7 bar (-12 to 100 psi) -0.82 to 20 bar (-12 to 300 psi) -0.82 to 35 bar (-12 to 500 psi)
mA	0 to 24.000 mA
RTD	-40.0°C to 155.0°C (-40.0°F to 311.0°F)
Engineering Units	psi, bar, mbar, kPa, MPa, kg/cm2, mmH2O @ 4°C, mmH2O @ 20°C, cmH2O @ 4°C, cmH2O @ 20°C, inH2O @ 4°C, inH2O @ 20°C, inH2O @ 60°F, mmHg @ 0°C, inHg @ 0°C

Accuracy 18°C to 28°C (unless otherwise noted)

HPC550 Ex and HPC552 Ex	
+/- 25 mbar	± 0.1% F.S. (± 0.15% F.S. 0°C to 45°C)
Vacuum	same as above
+/- 70 mbar, +/- 350 mbar	± 0.05% F.S. (± 0.1% F.S. 0°C to 45°C)
Vacuum	same as above
All compound ranges not listed above	± 0.025% Reading ± 0.01% F.S. (± 0.04% Rdg ± 0.01% F.S. 0°C to 45°C)
Vacuum	± 0.025% F.S. (± 0.05% F.S. 0°C to 45°C)
Absolute ranges	± 0.025% Reading ± 0.01% F.S. (± 0.04% Rdg ± 0.01% F.S. 0°C to 45°C)
Gauge ranges	± 0.025% Reading ± 0.01% F.S. (± 0.04% Rdg ± 0.01% F.S. 0°C to 45°C)
Gauge range 10k	± 0,025% Reading + 0.015% F.S. (± 0.040% Rdg + 0.015% F.S.)
Gauge range 700 bar	± 0.025% Reading ± 0.015% F.S. (± 0.04% Rdg ± 0.015% F.S. 0°C to 45°C)
All ranges - Temperature Effect	-10°C to 0°C is ± 0.005% FS/°C

Electrical	
mA	± 0.015% of rdg ± 0.002mA
RTD (ohms)	± 0.015% of rdg ± 0.02 ohms; or ± 0.1°C @ 0°C for Pt100
Switch-Test	5 VDC (< 1mA)
Temperature Effect - Electrical Ranges Add ± 0.001% F.S./°C for temps below 18°C and temps above 28°C unless specified otherwise.	
Optional Probe	Meets PT-100 ALPHA 385/EN751 Class "A" Specifications

12. Maintenance

12.1 Replacing Batteries

Replace batteries as soon as the battery indicator turns on to avoid false measurements. If the batteries discharge too deeply the HPC550 Ex/ HPC552 Ex will automatically shut down to avoid battery leakage.

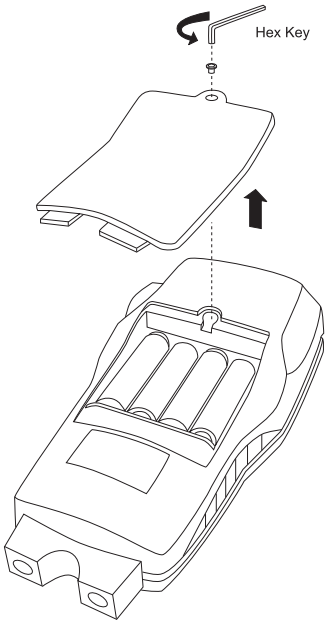
Note: Use only AA size alkaline batteries.

Warning

Only change batteries in an area known to be non-hazardous.

Approved Batteries

Battery Manufacturer (All Batteries Alkaline - A 1.5 V)	Type
Duracell	MN1500
Rayovac	Max Plus 815
Eveready (Energizer)	E91
Panasonic	LR6XWA



12.2 Cleaning the Unit

Warning

To avoid personal injury or damage to the calibrator, use only the specified replacement parts and do not allow water into the case.

Caution

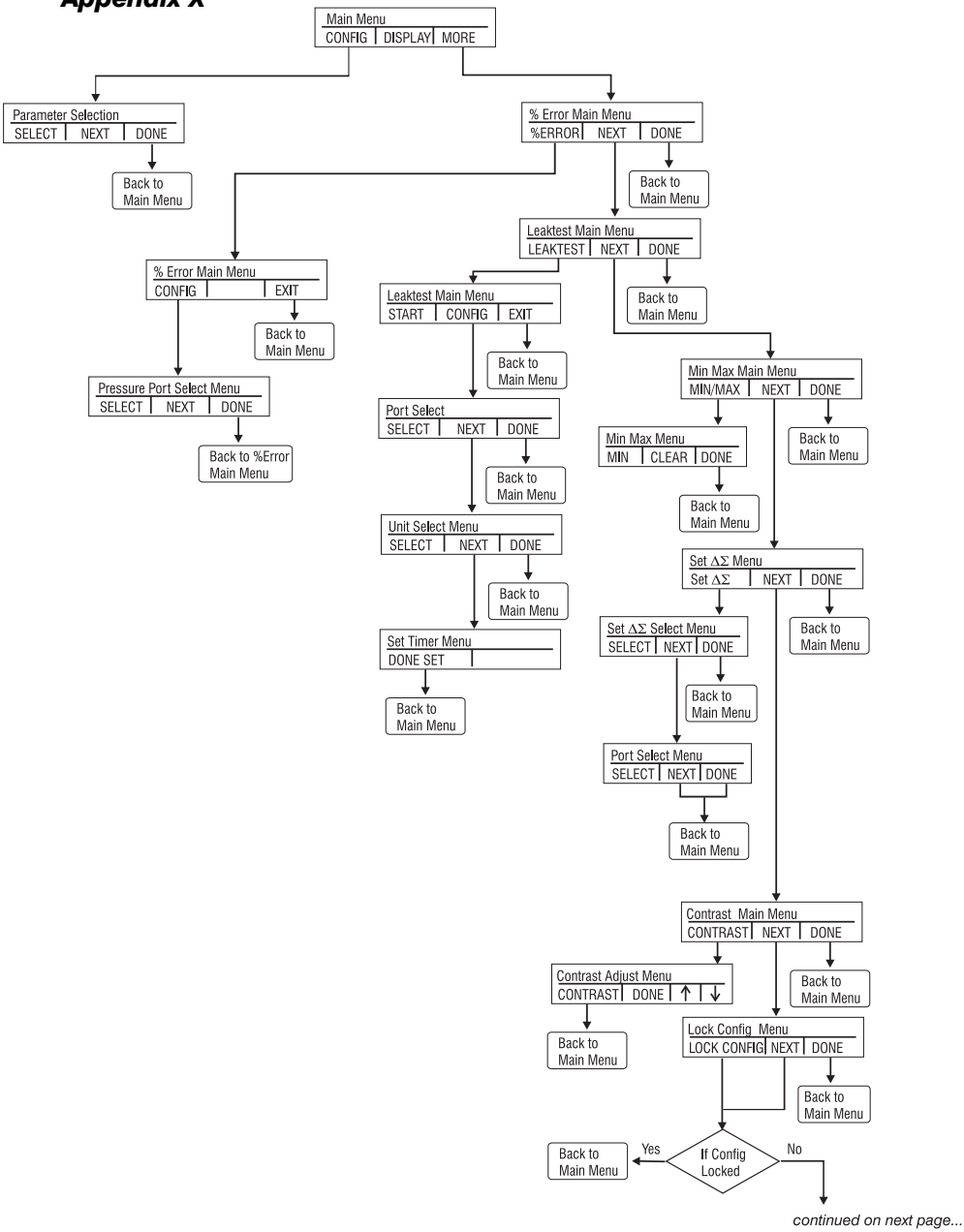
To avoid damaging the plastic lens and case, do not use solvents or abrasive cleansers. Clean the calibrator with a soft cloth dampened with water or water and mild soap.

12.3 Service Center Calibration or Repair

Only qualified service personnel should perform calibration, repairs, or servicing not covered in this manual. If the calibrator fails, check the batteries first, and replace them if needed.

Verify that the calibrator is being operated as explained in this manual. If the calibrator is faulty, send a description of the failure with the calibrator. Be sure to pack the calibrator securely, using the original shipping container if it is available.

Appendix X



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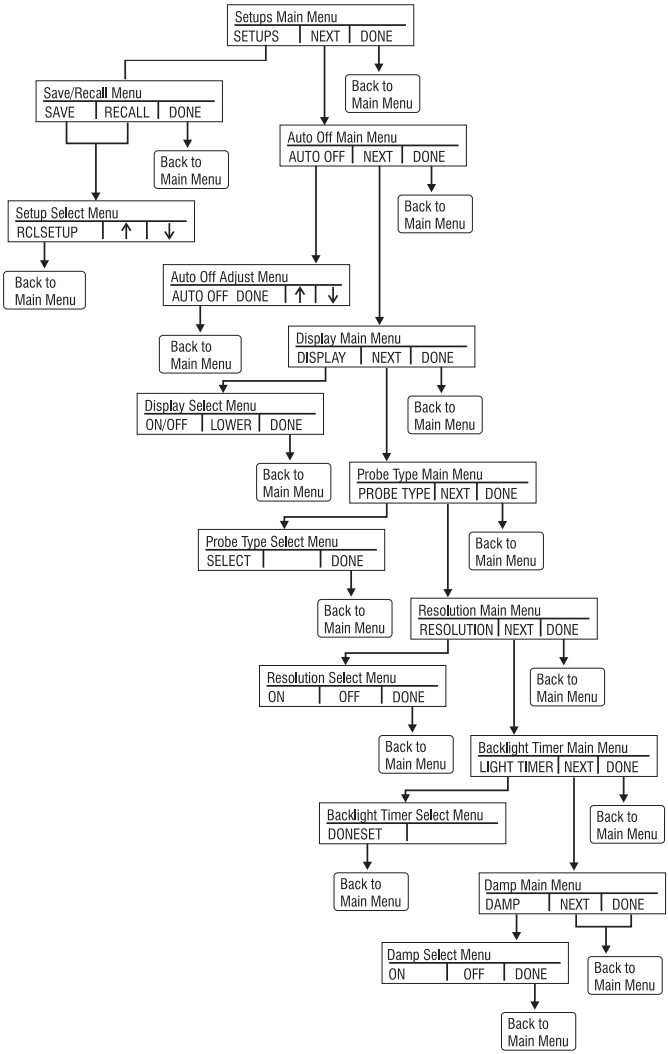
Setups Main Menu
SETUPS | NEXT | DONE
Back to Main Menu
Save/Recall Menu
SAVE | RECALL | DONE
Back to Main Menu
Auto Off Main Menu
AUTO OFF | NEXT | DONE
Back to Main Menu
Setup Select Menu
RCLSETUP | ↑ | ↓
Back to Main Menu
Auto Off Adjust Menu
AUTO OFF DONE | ↑ | ↓
Back to Main Menu
Display Main Menu
DISPLAY | NEXT | DONE
Back to Main Menu
Display Select Menu
ON/OFF | LOWER | DONE
Back to Main Menu
Probe Type Main Menu
PROBE TYPE | NEXT | DONE
Back to Main Menu
Probe Type Select Menu
SELECT | DONE
Back to Main Menu
Resolution Main Menu
RESOLUTION | NEXT | DONE
Back to Main Menu
Resolution Select Menu
ON | OFF | DONE
Back to Main Menu
Backlight Timer Main Menu
LIGHT TIMER | NEXT | DONE
Back to Main Menu
Backlight Timer Select Menu
DONESET
Back to Main Menu
Damp Main Menu
DAMP | NEXT | DONE
Back to Main Menu
Damp Select Menu
ON | OFF | DONE
Back to Main Menu

AMETEK JOFRA™ HPC550 Ex/552 Ex Ranges and Resolutions

Range (bar)		25mbar	70mbar	350mbar	1	1.1	2	7	20	35	70	200	350	700
Burst Pressure (bar)		200mbar	650mbar	1	6	6	6	70	133	133	700	700	700	1000
Proof Pressure (bar)		70mbar	200mbar	650mBar	4	4	4	13	40	70	200	400	700	1000
Static Pressure (bar)		70mbar	7	7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Range (psi)		0.4	1	5	15	16	30	100	300	500	1000	3000	5000	10000
Burst Pressure (psi)		3	10	15	90	90	90	1000	2000	2000	10000	10000	10000	15000
Proof Pressure (psi)		1	3	10	30	30	60	200	600	1000	3000	6000	10000	15000
Static Pressure (psi)		1	100	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sensor Type		non-isolated	non-isolated	non-isolated	non-isolated	non-isolated	non-isolated	isolated	isolated	isolated	isolated	isolated	isolated	isolated
Range Type		differential	differential	differential	compound	absolute	compound absolute	compound absolute	compound absolute	compound	gauge	gauge	gauge	gauge
psi	1	0.4000	1.0000	5.0000	15.000	16.000	30.000	100.00	300.00	500.00	1000.0	3000.0	5000.0	10000
bar	0.06894757	0.0276	0.0689	0.3447	1.0342	1.1032	2.0684	6.8948	20.684	34.474	68.948	206.84	344.74	689.48
mbar	68.94757	27.579	68.948	344.74	1034.2	1103.2	2068.4	6894.8	20684	34474	68948	NA	NA	NA
kPa	6.894757	2.7579	6.8948	34.474	103.42	110.32	206.84	689.48	2068.4	3447.4	6894.8	20684	34474	68948
MPa	0.006894757	0.0028	0.0069	0.0345	0.1034	0.1103	0.2068	0.6895	2.0684	3.4474	6.8948	20.684	34.474	68.948
kg/cm2	0.07030697	0.0281	0.0703	0.3515	1.0546	1.1249	2.1092	7.0307	21.092	35.153	70.307	210.92	351.53	703.07
cmH2O @ 4°C	70.3089	28.124	70.309	351.54	1054.6	1124.9	2109.3	7030.9	21093	35154	70309	NA	NA	NA
cmH2O @ 20°C	70.4336	28.173	70.434	352.17	1056.5	1126.9	2113.0	7043.4	21130	35217	70434	NA	NA	NA
mmH2O @ 4°C	703.089	281.24	703.09	3515.4	10546	11249	21093	70309	NA	NA	NA	NA	NA	NA
mmH2O @ 20°C	704.336	281.73	704.34	3521.7	10565	11269	21130	70434	NA	NA	NA	NA	NA	NA
inH2O @ 4°C	27.68067	11.072	27.681	138.40	415.21	442.89	830.42	2768.1	8304.2	13840	27681	83042	NA	NA
inH2O @ 20°C	27.72977	11.092	27.730	138.65	415.95	443.68	831.89	2773.0	8318.9	13865	27730	83189	NA	NA
inH2O @ 60°F	27.70759	11.083	27.708	138.54	415.61	443.32	831.23	2770.8	8312.3	13854	27708	83123	NA	NA
mmHg @ 0°C	51.71507	20.686	51.715	258.58	775.73	827.44	1551.5	5171.5	15515	25858	51715	NA	NA	NA
inHg @ 0°C	2.03603	0.8144	2.0360	10.180	30.540	32.576	61.081	203.60	610.81	1018.0	2036.0	6108.1	10180	20360

Proof Pressure - maximum allowable pressure without a shift in calibration
Burst Pressure - sensor damaged or destroyed; some risk of personal injury
Static Pressure - Differential units only. Maximum allowed common mode pressure between both ports.

AMETEK Calibration Instruments
One of the world's leading manufacturers and developers of calibration instruments for temperature, pressure and process signals as well as for temperature sensors both from a commercial and a technological point of view.

JOFRA Temperature Instruments
Portable precision thermometers. Dry-block and liquid bath calibrators: 4 series, with more than 25 models and temperature ranges from -90° to 1205°C/-130° to 2200°F.

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